PATENT

ATTORNEY DOCKET NO.: FMC-2

UNITED STATES PATENT APPLICATION

OF

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FOR

MULTI-WALL BAG

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MULTI-WALL BAG

RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional application having application serial number 60/429,004 filed November 25, 2002, and which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

This invention is directed towards a multi-wall bag having a tubular form comprising a plurality of overlapping, paper-containing plies of flexibly shaped material. Such bags are commonly used in packaging of pet food.

BACKGROUND OF THE INVENTION

This invention relates to stand-up pouches and multi-wall bags for use in packaging granulated or powdered products such as animal feed, chemicals, powdered milk, and other pourable types of products. Bags and pouches within this industry are frequently referred to as self-opening style (SOS) bags, pinched-bottom or open-mouthed bags, and valve sacks which are hereinafter collectively referred to as multi-wall bags. A multi-wall bag frequently includes a tear open tab located at least partially inside the bag and which is folded with the pinched closure between the walls of the bag.

One form of a multi-wall bag may be seen in reference to U.S. Pat. No. 3,687,356 assigned to St. Regis Paper Company and which describes single-wall and multi-ply wall gusseted type bags. Multi-wall bags of this basic construction have been widely used for the packaging of animal feed, particularly dog and cat food.

Recently, the exterior ply of multi-wall bags used within the pet food packaging industry were treated with fluorocarbons such as Scotch Guard® brand FC807 (3M) protectants designed to provide grease/oil resistance to the exterior surface of the outermost bag ply. The grease/oil barrier was achieved by adding the fluorocarbon to the pulp prior to making the paper. Additionally, clay-coated papers had additional fluorocarbon added to the clay slurry prior to coating the paper. Such treatments prevented grease and oil from sticking to the constituent paper fibers. Such chemical treatment has been adequate to provide grease/oil resistance to the bag's exterior surface while permitting the application of graphics and printing using conventional printing techniques.

Useful background information with respect to multi-wall bag containers may be found in the publication entitled, *Reference Guide For The Paper Shipping Sack Industry*, Copyright 1991, published by the Paper Shipping Sack Manufacturer's Association, Inc., of Tarrytown, New York, a 51-page guide which is incorporated herein by reference. The reference guide discusses paper finishes and treatments including use of fluoro-chemical agents to make paper resistant to oil and grease. While fluorocarbon coating of papers used to construct multi-wall bags has proven adequate within the industry, there remains room for improvement and variation within the art.

SUMMARY OF THE INVENTION

It is one aspect of one of the present embodiments of the invention to provide a paper layer suitable for use as the outermost ply of a single-ply or a multi-wall bag having improved resistance properties to grease, fat, and oils of animal or plant derivation and which exhibits excellent graphic printing capabilities.

It is yet another aspect of at least one of the present embodiments of the invention to provide a paper layer suitable for use as an outermost ply of a single-ply or a multi-wall bag having an outer ply layer of a coated paper which provides improved resistance to water, has improved graphic printing

capabilities, and increased tear resistance and strength properties compared to similar bags having an uncoated outer ply.

It is yet another aspect of at least one of the present embodiments of the invention to provide a paper layer suitable for use as a ply layer of a multi-wall bag in which the paper layer provides for low water vapor transmission rates (WVTR).

It is yet another aspect of at least one of the present embodiments of the invention to provide a multi-wall bag in which the outer ply layer comprises a natural kraft or bleached paper having a film layer of a biaxially oriented thermoplastic material such as polypropylene or polyester positioned as an outermost layer. An extruded thermoplastic layer, and/or a glue layer such as a conventional tie resin, polyurethane adhesive, or polyester adhesive, may be present between the paper and the film layer.

It is another aspect of at least one of the present embodiments of the invention to provide for a multi-wall bag construction having an outermost ply of a coated paper. The outer ply of coated paper results in an overall greater bag strength and brings about noted improvements in graphics, printing capabilities, and water vapor transmission rates, and permits bag dimensions of face width, tube length, and gusset width to be varied without having to change the composition or characteristics of the various ply layers which make up the bag. The added strength provided by the exterior coated paper substrate enhances the strength of the resulting bags such that standard variations in useful bag dimensions all have adequate strength for conventional bag contents such as pet food, cat litter, bird seed, and similar materials.

It is yet another aspect of at least one of the present embodiments of the invention to provide a coated paper layer suitable for use within a stand-up pouch container or a multi-wall bag in which a coated paper provides the outermost ply, the coated paper having an extruded structural layer of polyethylene to which a barrier film layer is bonded. The barrier film layer provides moisture resistance to the outer ply along with increased grease, fat, and oil resistance. The coated paper further provides an improved printing surface as compared to an untreated

paper. Additionally, the coated paper constituent layers provide a structural reinforcement to the base paper such that when the material is used as an outer ply for a multi-wall bag, the resulting bag strength is increased in comparison to an outer ply lacking the film and extruded layers.

It is yet another aspect of at least one of the present embodiments of the invention to provide for a three-ply multi-wall bag in which the outermost ply layer defines a coated paper layer comprising an outer layer of a biaxially oriented polyester, polypropylene, or other oriented thermoplastic film layer. The resulting ply of coated paper permits a 3-ply bag strength which is equivalent to or greater than that of a 4-ply multi-wall bag using similar ply layers with an uncoated outer ply.

These and other features, aspects, and advantages of the present invention will become better understood with reference to the following description and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

A fully and enabling disclosure of the present invention, including the best mode thereof, to one of ordinary skill in the art is set forth more particularly in the remainder of the specification, including reference to the accompanying drawings.

Figure 1 is a perspective view of a single-ply, pinch-bottom bag construction in accordance with the invention.

Figure 2 is a perspective view of an alternative embodiment of the invention showing a multi-wall 3-ply bag construction in which the bag plies are successively stepped along the open end of the bag.

Figure 3 is a cross-section taken along line 3-3 of Figure 1 providing details of a coated paper construction of one embodiment of the present invention.

Figure 4 is a cross-section similar to Figure 3 setting forth an alternative embodiment of a coated paper construction according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference will now be made in detail to the embodiments of the invention, one or more examples of which are set forth below. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention cover such modifications and variations as come within the scope of the appended claims and their equivalents. Other objects, features, and aspects of the present invention are disclosed in the following detailed description. It is to be understood by one of ordinary skill in the art that the present discussion is a description of exemplary embodiments only and is not intended as limiting the broader aspects of the present invention, which broader aspects are embodied in the exemplary constructions.

In describing the various figures herein, the same reference numbers are used throughout to describe the same material, apparatus or process pathway. To avoid redundancy, detailed descriptions of much of the apparatus once described in relation to a figure is not repeated in the descriptions of subsequent figures, although such apparatus or process is labeled with the same reference numbers.

As used herein, the term "coated paper" refers to a paper having a surface to which is adhered a biaxially oriented polyester or polypropylene film layer. One or more intervening layers of an extruded material or adhesive may also be present.

As seen in reference to Figures 1 and 2, an exemplary, non-limiting embodiment of the present invention is directed to a stand-up pouch or multi-wall bag having a pinched closure at one end. As seen in reference to Figure 1, the bag 10 defines at least one pinch-closable end and is formed from a ply of paper 20 which is folded to form a pinch closure. As seen in reference to Figure 1, bag

10 may be formed from a single paper ply 20. The bag has a front wall 12 and an oppositely disposed rear wall 14, rear wall 14 extending above the front surface 12 at one end of the tube when the bag is in its assembled condition as illustrated. As seen in Figure 1, the bag 10 defines a series of forward fold lines 22, 24, 26, and 28. Bag 10 further defines a pair of oppositely spaced gussets 32 and 34 which are positioned between the respective front and rear walls of bag walls 12 and 14.

In reference to Figure 2, a multi-ply bag embodiment is referenced having a rear wall 14 that comprises a plurality of three plies including an outer ply 50 of a coated paper as described herein, a second ply 52, and an innermost ply layer 54. Ply layers 52 and 54 may be formed of natural kraft paper, converter kraft, or other conventional paper stock. The construction of single-wall and multi-wall gusseted type bags is well known in the art as may be found in reference to U.S. Pat. Nos. 3,687,356 and 6,599,016 which are incorporated herein by reference.

Exemplary bags seen in Figures 1 and 2 may be constructed from a coated paper in which the single ply or outermost ply comprises a coated paper having an exterior surface of a biaxially oriented film layer. As best seen in reference to Figure 3, one embodiment of a coated paper 20 is provided in which paper 20 comprises an innermost paper substrate layer 40. Paper substrate layer 40 may be in the form of a natural kraft, converter kraft, bleached paper, or extensible kraft paper. Conventional paper weights for multi-wall bags used in the pet food industry use kraft paper for inner ply layers corresponding to a 40 to 60 pound weight paper. Along an exterior surface of the coated paper 20, a 5 to 15 pound layer (per 3000 sq. ft. of paper stock) of a polyethylene 42 is extrusion coated onto the paper. The polyethylene extruded layer 42 provides a smooth surface to the coated paper while providing a bondable surface for applying a subsequent film layer. Useful polyethylenes for layer 42 include low density polyethylene (LDPE), linear low density polyethylene (LLDPE), polyethylene-based adhesive tie layers, polyethylene terepthalate (PET), as well as other polymers as conventionally used to laminate paper or paperboard substrates. Following application of the polyethylene layer 42, a biaxially oriented

thermoplastic material 44 such as polypropylene or polyester film is applied. When polyester film is used, a useful thickness of the biaxially oriented film layer is about 48 gauge, although a range of about 30 gauge to about 98 gauge is believed useful. In the case of biaxially oriented polypropylene, a film thickness of about 55 gauge has been found useful, although it is believed that a range of about 40 to about 100 gauge is also useful. Applying a biaxially oriented polyester or polypropylene film to a paper or laminated paper substrate may be carried out using conventional techniques well known within the art.

In accordance with the present invention, it has been found that polypropylene biaxially oriented films having a melting point of between 325° to 330° F prove useful. In addition, it has been found that having an acrylic coating applied to the exterior surface of the film, i.e., print ink receiving surface, improves the film's surface receptivity to inks and hot melts. Suitable polypropylene films, including films having acrylic coatings are commercially available from AET Films, Inc. (New Castle, DE) and ViFan, a division of Vibac (Morristown, TN). Further, it has been noted that selection of a smooth finished kraft paper such as machine glazed paper available from Longview Fibre Company (Longview, Washington), may reduce by up to 50 percent the amount of the polyethylene extrusion coating required to achieve a smooth surface for applying the subsequent film layer 44.

As seen in reference to Figure 4, an alternative embodiment of the present invention makes use of a paper layer 40 with an extruded polyethylene layer 42 similar to that described above in reference to Figure 3. The biaxially oriented thermoplastic layer may additionally include a foil or metal layer 48. By way of example, an aluminum foil layer may have a thickness of about 1 to 2 angstroms with an optical density (OD) ranging from about 2.0 to about 3.5. On top of the foil layer 48 is the biaxially oriented thermoplastic layer 44 of polypropylene or polyester. Preferably, metal layer 48 and the thermoplastic film layer 44 may be applied in a single step using a vacuum metallized oriented polypropylene sheet. Suitable metallized oriented polypropylene film is available from AET Films, Inc. (New Castle, DE) and ViFan (Morristown, TN).

In paper layer 40, seen in reference to Figures 3 and 4, the polyethylene layer 42 provides a smooth, outer surface to the paper layer 40. The smooth surface provided by layer 42 facilitates the subsequent application of the polypropylene or polyester film 44 and which may include optional foil layer 48. As a result, film 44 provides a smooth, even exterior surface which facilitates subsequent printing of bag graphics onto film layer 44 using, for example, conventional flexo printing or gravure printing techniques. In the described embodiments, there is no need for an overprint varnish or separate oil/grease resistant coating to be applied following printing.

In accordance with the present invention, it has been found that the biaxially oriented thermoplastic coated kraft paper offers several advantages with respect to the construction of a multi-wall bag. Foremost, the biaxially oriented thermoplastic film layer has been found to provide an improved printing surface as opposed to kraft papers which have been treated with a fluorochemical agent. The improved printing surface is achieved, in part, by providing a smoother and non-abrasive printing surface. As a result, the printing surface requires less ink to be applied while enhancing the sharpness and contrast of the applied inks. Consequently, ink printing costs are lowered. The resulting graphics are cleaner and crisper since the absorptive paper layer does not directly interact with or absorb the ink as occurs with fluorochemically treated papers.

Similar properties are also achieved when using the metal or foil layer embodiment. Again, an improved print quality is achieved while at the same time using less ink. As set forth in Table 1A, paper coated with the metal or foil layer also exhibits excellent WVTR properties.

Additionally, the use of the coated paper as set forth in the various embodiments offers additional advantages in printing operations. To the extent different types of kraft papers may be used on consecutive printing runs, there is no longer a need to switch inks based upon the type of paper. When various types of kraft paper are coated according to the present invention, the resulting papers are all compatible with a single type of ink and do not require time consuming and costly ink switching at the printing stage.

Additionally, coated paper when used as an outer ply for a multi-wall bag results in the outer ply having improved strength properties and tear resistance compared to a similar bag made with an uncoated kraft paper. For instance, when a kraft paper, rated at a conventional 41 pounds, is coated as set forth above in reference to Figure 3, the resulting coated paper has a rating of between about 70 to about 80 pounds. Without the biaxially oriented film coating, a 41 pound kraft paper when treated with a traditional calendaring, clay coating, or metalizing process contributes only 15 to 20 pounds of strength under Uniform Freight Classification ICC Rule 40. This additional strength, a direct result of the biaxially oriented film layer 44, allows a 25 pound bag of pet food which is conventionally shipped in a 4-ply bag to be shipped in a 3-ply bag. As a result, the material and shipping costs of the bag are decreased while achieving the attendant improvements noted above with respect to improved graphics and printability.

The use of the coated paper in a multi-wall bag construction permits a converter kraft grade of interior ply layers to be used while still meeting the requirements of ICC Rule 40. Heretofore, compliance with ICC Rule 40 effectively excluded the use of less expensive converter kraft grades in multi-wall bags in favor of the more expensive and stronger natural kraft papers. The use of coated paper in bag construction allows interior ply layers to be made of converter kraft while still meeting the performance standards set forth in ICC Rule 40.

Tables 1A and 1B below set forth test data with respect to physical properties and performance data of polypropylene coated bleached kraft papers and metallized polypropylene coated natural kraft papers, along with various control kraft and metallized kraft papers. With respect to the test results seen in Tables 1A and 1B, the paper weight was determined according to TAPPI official test method T-410. Porosity measurements were made according to TAPPI official test method T-460. The tensile strength and tear resistance determination of the paper were made using TAPPI test methods T-494 and T-414 respectively. The Dart Impact data was collected using ASTM 1709 methods. While not

separately set forth, the coated paper was noted to have excellent glueability properties with respect to paper-paper, paper-film, and film-paper adhesion.

As noted in Table 1A, the WVTR properties of the coated paper are significantly improved compared to WVTR values for conventional prior art outer ply construction. When incorporated into a multiple wall bag, the coated paper enhances the freshness of products sealed within the bag. In addition, decreasing vapor loss also provides for improved odor control. The ability to provide for grain and animal food products in a low odor release bag can be important in retail environments where odors may be absorbed by clothing merchandise or be objectionable to near food dispensing areas.

As further noted in Tables 1A and 1B, the properties of the coated paper have the indicated values for tear and strength properties. As seen in reference to Table 1B, the single sheet and samples 1 through 3 have a core fiber basis weight of about 50. Following coating with the biaxially oriented polypropylene film, the basis weight and strength increases as indicated in Table 1B when compared to the comparison 1 natural kraft 50-pound basis weight paper and the comparison 2 43-pound basis weight metallized prior art paper. As provided for in Table 2, the overall improvements in bag strength which result from use of the coated paper on an exterior ply may be seen in comparison to control bags without the coated paper enhancement.

T st D scription		PP /Extruded/ BL NK		MET PP/Extruded/ NK		MET PP/Extruded/ NK	
Basis Weight *(Llbs/3000ft²)*		70.715		72.738		68.0	
Porosity *(Sec/100cc Air)* TAPPI T460	**Avg.:** **Std. Dev.:** **Low:** **High:**	Exceeds 1800 seconds		Exceeds 1800 seconds		Exceeds 1800 seconds	
20° Gloss *(Degrees)* TAPPI T480	**Avg.:** **Std. Dev.:** **Low:** **High:**	34.3 1.83 31.8 36.9		*0 @ 20° and 60° Geometry*		*0 @ 20° and 60° Geometry*	
		MD	**CD**	**MD**	**CD**	**MD**	**CD**
Tensile *(Lbf/in)* TAPPI T494	**Avg.:** **Std. Dev.:** **Low:** **High:**	36.38 1.74 33.37 37.60	19.22 1.38 17.05 20.55	49.51 3.10 46.42 53.65	22.65 1.96 19.40 24.65	46	28
TEA *(Ftlbs/ft²)* TAPPI T494	**Avg.:** **Std. Dev.:** **Low:** **High:**	4.02 0.39 3.39 4.44	53.20 16.26 25.48 66.60	7.81 1.55 6.51 9.73	26.05 4.85 21.38 33.21	7.3	24
Tear *(Grams)* TAPPI T414	**Avg.:** **Std. Dev.:** **Low:** **High:**	159.6 9.6 148.0 174.6	148.5 8.3 141.4 161.0	125.5 11.6 114.5 142.3	187.7 3.2 182.7 191.6	137	134
WVTR *(g/100in²/24hrs@ 100°F and 90°RH)* ASTM E-96-80		0.48		0.01		0.01	

Table 1A

					Single Sheet ONTIC White	Single Sheet Comparison				
						COMPARISON 1	ONTIC Metal			COMPARISON 2
						NK	Sample 1 METAL	Sample 2	Sample 3	Vac Met C1S/Metallized
		Basis Weight (before/after coating)			50/70	50	50/72	50/72	50/72	43
Test Parar	Test Discripto	Test	Test Units	Test Methods						
Impact		Dart Drop Impact	Ft.- lb force	ASTM 1709		0.2045		0.6547		
			Std Dev			0.029		0.165		
Mullen A	NA	Mullen A Avg	lbs/sq in		101	46		79	67	32
		Mullen A Std Deviat	lbs/sq in		14	2		16	7	4
Tear	MD	Tear Avg	gms	TAPPI	159.6	133.1	125.5	137.68	136.18	49.6
		Tear Std Deviation	gms	T-414 om-88	9.6		11.6	6.53	5.05	1.03
	CD	Tear Avg	gms		148.5	125.7	187.7	138.14	131.62	46.98
		Tear Std Deviation	gms		8.3		3.2	3.77	4.56	1.92
Tensile	MD	Tens Energy Abs Av	Ft-lb/sq ft	TAPPI	4.02		7.81		4.69	2.2
		Tens Energy Abs St	Ft-lb/sq ft	T-494 om-88	0.39		1.55		0.64	0.78
		Tens Ext Stif Avg	lbs/inch						3940	2770
		Tens Ext Stif Std De	lbs/inch						221	115
		Tens Stretch Avg	Percent				6.51		1.6	1.29
		Tens Stretch Std De	Percent				9.73		0.16	0.26
		Tensile Avg	lbs/inch		36.38		49.51		39.2	22.5
		Tensile Std Deviatio	lbs/inch		1.74		3.1		1.4	3
	CD	Tens Energy Abs Av	Ft-lb/sq ft		53.2		26.05		19.4	4.51
		Tens Energy Abs St	Ft-lb/sq ft		16.26		4.85		1.05	1.24
		Tens Ext Stif Avg	lbs/inch						1870	1250
		Tens Ext Stif Std De	lbs/inch						129	65
		Tens Stretch Avg	Percent				21.38		6.5	3.79
		Tens Stretch Std De	Percent				33.21		0.27	0.81
		Tensile Avg	lbs/inch		19.22		22.65		32.1	13.3
		Tensile Std Deviatio	lbs/inch		1.38		1.96		1	1.2
WVTR				ASTM F-372						

TABLE 1B

The coated paper is useful for single-wall bags, multi-ply bags, or stand-up pouches in which the outermost ply is of a coated paper as described herein. The resulting bag has advantages in terms of the mechanical packaging capabilities of the bag. The exterior, i.e., printed surface of the bag/paper has an extremely smooth and glossy texture. Suction belts and cups used on mechanical packaging equipment are able to better grasp the bag. The improved gripping results in bag processing in which the outer face is not torn or damaged by the use of overly aggressive handling techniques or application of excessive vacuum pressure to the handling equipment.

The improved bag strength which results from inclusion of the coated paper in the bag construction significantly increases the tear resistance of the bag. Consumers will often grab a bag along an upper seam or gusset wall. The coated paper provides sufficient tear resistance to the bag that the integrity of the bag is maintained during handling along key stress points. This additional strength also facilitates the incorporation of handles into the bag, such handles being known in the art.

Further, bags made with the biaxially oriented film-coated paper are more resistant to punctures, tears, and abrasion of the exterior layer. The exterior layer comprises the print surface upon which packaging graphics are printed. As a result, the improved strength and tear resistance maintains the shelf appeal of the packaging. Consumers perceive visible tears or abrasions in bag packaging as an indication of underlying weakness of the bag and/or a compromise of the product's integrity. By reducing the incidence of tears and abrasions in the bag exterior, retailers do not have to discount or remove as much product as a result of damaged packaging.

An additional benefit of providing a multi-wall bag having the outer ply of the coated paper described herein is that the resulting bags have shown improved resistance to external moisture damage. Heretofore, conventional pet food bags and similar products had an exterior ply layer which offered poor resistance to moisture. As a consequence, exposure of the bag to rain or

moisture would greatly weaken the bag strength. Further, visible moisture damage lessened the attractiveness of the bag graphics and was frequently perceived by the consumers as indicative of potentially spoiled or damaged goods. The use of the coated paper, described herein as the exterior ply layer, substantially increases the resistance of the bag to moisture. This resistance has positive effects on the bag strength as well as the appearance of the bag graphics.

The biaxially oriented coated paper described herein provides a more stable outer ply for use in a multi-wall converting process. Not only will the coated paper allow use of fewer plies, or alternatively the use of lower basis weight paper for intermediate plies, the reduction in ply numbers and/or basis weight has advantages in the bag manufacturing process. The increased stability of the outer ply allows higher bag machine and tuber speeds to be utilized, increasing the efficiency of the bag-making operation.

Additionally, the coated paper of the present invention maintains stability during the converting process. For instance, using conventional exterior ply paper, the conventional outer ply becomes very brittle and difficult to convert following printing of the outer ply. The increased brittleness is brought about by water loss occurring during the printing/lamination process. In comparison, the biaxially oriented coated paper of the present invention exhibits minimal moisture loss during converting and printing steps. As such, the outer ply material is easier to handle and any associated natural kraft or bleached base paper in the interior plies is likewise maintained in a good condition.

During printing production steps, the biaxially oriented coated paper exhibits improvements in manufacturing efficiencies. A significant time factor of printing on prior art paper involves the drying of the paper following application of one or more ink colors. Using the biaxially oriented coated paper reduces the ink volume by a factor of two to three without loss of color intensity or hues. Since printing occurs directly on the film side of the paper, there is no to minimal

absorption of the ink which reduces drying requirements, uses less ink, and helps maintain favorable moisture conditions by minimizing use of drying ovens. As a result, the graphics printing can be done at a higher rate of speed and using less inks than on a conventional outer ply paper of conventional design.

The outer ply layer heretofore used within the bag industry exhibits a tendency to crack when folded during a bag-making operation. As a result, the gussets and bottom folds often exhibit a poor appearance and undesirable shelf appeal. Additionally, the crack impairs whatever barrier properties may have been present within the conventional outer ply layer. The present invention's use of a biaxially oriented polypropylene or polyester has been found to greatly increase the flex characteristics of the paper. As a result, folds and creases are additionally protected from cracking and thereby increase both the appearance as well as the barrier properties of the resulting multi-wall bags.

Additionally, the biaxially oriented films of the coated paper described herein will readily receive an extruded or film applied heat seal coating such as a low density polyethylene. As such, the coated paper of the present invention becomes an ideal substrate for stand-up pouches and other containers where heat sealing may be used to seal the container. As previously noted, the coated paper of the present invention also exhibits excellent properties with respect to glueability.

Additionally, sealed multi-wall bags in which the exterior ply comprises the coated paper of the present invention have demonstrated improved properties with respect to control bags in standard drop tests. Set forth in Table 2 is comparative data between a conventional 4-ply metallized bag (37.5 lb. capacity) having a fluorchemical outer ply treatment in comparison to a similar multi-ply bag having the outermost ply of a coated paper using the metallized biaxially oriented film (ONTIC™) as described herein.

Test Parameter	T st	Test	T st Units	OLD 4-PLY BAG	NEW 4-PLY BAG
Mullen A (bursting)	NA	Mullen A Avg	lbs/sq in	143	215
D774M-97		Mullen A Std Dev.	lbs/sq in	9	12
Tear	MD	Tear Avg	gms	127.3	173.26
		Tear Std Deviation	gms	6.08	8.92
	CD	Tear Avg	gms	119.04	138.78
		Tear Std Deviation	gms	4.39	8.77
Tensile	MD	Tens Energy Abs Avg	Ft-lb/sq ft	13.4	13.5
		Tens Energy Abs Std Dev.	Ft-lb/sq ft	1.83	1.09
		Tens Ext Stif Avg	lbs/inch	10000	10500
		Tens Ext Stif Std Dev.	lbs/inch	273	411
		Tens Stretch Avg	Percent	1.55	1.39
		Tens Stretch Std Dev.	Percent	0.17	0.18
		Tensile Avg	lbs/inch	96.6	102.5
		Tensile Std Deviation	lbs/inch	6.8	11.5
	CD	Tens Energy Abs Avg	Ft-lb/sq ft	34.8	53.8
		Tens Energy Abs Std Dev.	Ft-lb/sq ft	0.75	9.07
		Tens Ext Stif Avg	lbs/inch	4190	5950
		Tens Ext Stif Std Deviation	lbs/inch	201	233
		Tens Stretch Avg	Percent	3.82	3.44
		Tens Stretch Std Deviation	Percent	0.43	0.35
		T nsile Avg	lbs/inch	57.2	72.4
		Tensile Std Deviation	lbs/inch	2.9	2.8

BAG COMPARISON

Bag: 75 OPP/2-60 NK/Outer Ply
Outer Ply Old: 43 C1S/Metallized
Outer Ply New: ONTIC Metal

Table 2

Multi-wall bags made according to the exemplary embodiments described above exhibit excellent resistance to grease migration through the packaging. Grease barriers are important with respect to packaged animal feed including dog food or cat food. It has been found that multi-wall bags as referenced in Table 2 using the biaxially coated paper will provide a grease barrier for 30 days when tested using refined poultry fat maintained in the bags at temperatures of 120° F.

The improvements in overall bag strength brought about by incorporation of the biaxially oriented film-coated paper results in a bag packaging having three times the resistance to impact damage compared to a conventional bag of 50 lb. natural kraft paper. As a result, it is possible to eliminate one or more plies from a multi-ply bag when the exterior bag layer is comprised of the biaxially coated paper described herein. As a result, packaging bags can be provided which are stronger than comparative bags, use less material, offer improved print and graphic capabilities, have improved resistance to abrasion and tearing of the bag exterior surface, and offer improvements in terms of water vapor transmission properties, water resistance properties, and grease barrier properties. Such improvements, depending upon the bag size and contents, may permit a single-wall bag or stand-up pouch of superior performance to be constructed using biaxially oriented film coated paper. As noted in Table 2, the burst strength (Mullen A) of the bag is improved by about 33% in comparison to an identical bag having an uncoated outer ply.

The ability to vary the dimensions of width, gusset size, and tube length allow one to provide for a multi-ply bag having a lower center of gravity and using the same materials as similar volume bags but having a higher center of gravity. The lower center of gravity places greater stress upon certain seams used to form the bag. The inclusion of the coated paper as the outermost ply provides sufficient bag strength that variations in bag dimensions may be readily made without having to change the underlying materials used to form the various ply layers.

While many of the above referenced embodiments discuss the use of extrusion to apply various layers to the coated paper, it is understood by one having ordinary skill in the art that one or more of the applied layers coating the paper may be provided by the application of films. The use of films to provide layers within a coated paper or board structure is well known within the art.

Although preferred embodiments of the invention have been described using specific terms, devices, and methods, such description is for illustrative purposes only. The words used are words of description rather than of limitation. It is to be understood that changes and variations may be made by those of ordinary skill in the art without departing from the spirit or the scope of the present invention, which is set forth in the following claims. In addition, it should be understood that aspects of the various embodiments may be interchanged, both in whole or in part. Therefore, the spirit and scope of the appended claims should not be limited to the description of the preferred versions contained therein.